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Keywords: Corporate finance, risk management, exposure, foreign exchange rates, derivatives

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Corporate Hedging and Shareholder Value

Abstract

According to financial theory, corporate hedging can increase shareholder value in the presence of capital market imperfections such as direct and indirect costs of financial distress, costly external financing, and taxes. This paper presents a comprehensive review of the extensive existing empirical literature that has tested these theories, documenting overall mixed empirical support for rationales of hedging with derivatives at the firm level. While various empirical challenges and limitations advise some caution with regard to the interpretation of the existing evidence, the results are, however, consistent with derivatives use being just one part of a broader financial strategy that considers the type and level of financial risks, the availability of risk-management tools, and the operating environment of the firm. In particular, recent evidence suggests that derivatives use is related to debt levels and maturity, dividend policy, holdings of liquid assets, and the degree of operating hedging. Moreover, corporations do not just use financial derivatives, but rely heavily on pass-through, operational hedging, and foreign currency debt to manage financial risk.

1   Motivation

Non-financial firms engage in corporate risk management on a regular basis, as documented in their annual reports or surveys of derivatives' use (see e.g. Bodnar et al., 2003; 1999; 1998; Tufano, 1996 for the U.S.). For most non-financial firms, the main objective of their risk-management activities consists of hedging against foreign exchange rate and interest rate risk (84% and 76% of the U.S. survey's derivatives' users, respectively), even though firms often also attempt to time hedging decisions based on their market views, a practice called 'selective hedging' (Brown et al., 2006). The fact that derivatives use is common practice appears *prima vista* in line with existing positive theories that justify risk management at the firm level as beneficial to the shareholders of a firm in the presence of capital market imperfections. While these theories suggest several ways in which corporate hedging can increase shareholder value (e.g. by lowering the costs of financial distress), the empirical evidence that numerous studies provide remains controversial and without a clear bottom line.

Therefore, this paper contributes to the literature by providing a detailed and comprehensive overview and analysis of the theoretical arguments and the corresponding empirical evidence in the existing literature pertaining to corporate risk management as a lever for shareholder value creation. In particular, it summarizes theoretical arguments suggesting that shareholders' wealth can be increased through corporate hedging by exploiting capital market imperfections that result in underinvestment and asset substitution problems, costly divergent interests between managers and shareholders, costly external financing, direct and indirect costs of financial distress, and taxes. The paper reviews the proxy variables that have been used to test these hypotheses, as well as presents and discusses the empirical evidence

of the many studies testing positive rationales of corporate hedging. While there is some evidence in support of theoretical predictions, the empirical results are overall fairly mixed.

Thus, it would appear that existing theoretical explanations have little to no explanatory power for determining which firms use derivatives. At the same time, it may be that risk management arises from other factors not well motivated by existing risk management theory, such as earnings smoothing, speculation, or industry competition, that are difficult to examine empirically (Core et al., 2002; Brown, 2001; Tufano, 1996). Nevertheless, the results are in line with derivatives use being just one part of a broader financial strategy that considers the type and level of financial risks, the availability of risk-management tools, and the operating environment of the firm. In particular, recent evidence suggests that derivatives use is related to debt levels and maturity, dividend policy, holdings of liquid assets, and the degree of operating hedging (Bartram, Brown and Fehle, 2009). Moreover, corporations do not just use financial derivatives, but rely heavily on pass-through, operational hedging, and foreign currency debt to manage financial risk (Bartram, Brown and Minton, 2009; Guay and Kothari, 2003; Kedia and Mozumdar, 2003). Overall, these corporate hedging activities appear to be effective, since an extensive literature shows only weak evidence of the effect of financial risks, such as unexpected exchange rate changes, on stock returns.

At the same time, a number of empirical challenges and potential shortcomings may limit the conclusions that can be drawn from some of the existing evidence. In particular, most empirical studies fail to account for the endogeneity of variables describing different dimensions of corporate financial policy and strategy, such as investment opportunities, leverage, dividends, etc. Worse, there are significant identification problems for techniques such as simultaneous equations models. To illustrate, most determinants of leverage are also im-

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portant for hedging decisions. Few studies have tried to address these issues with simultaneous equations or structural corporate finance models that may reduce some of these issues and take a step towards yielding unbiased estimates of the underlying structural parameters.

A detailed understanding of the underlying structural parameters is also required in order to be able to properly capture complex relations between risk management and other corporate policies/characteristics. To illustrate, growth opportunities imply stronger motives for corporate hedging due to bigger underinvestment problems, but they are also associated with fewer free cash flow problems, which reduce the incentives to hedge. The complexities of these relations make it difficult to estimate such firm-specific parameters using cross-sectional data.

Furthermore, there are several challenges with capturing financial risk management at the firm level. While financial theory provides rationales for corporate hedging in general and while firms use a combination of different hedging channels in corporate practice (including derivatives, foreign currency debt, operational hedging, and pass-through), empirical tests frequently focus only on derivatives use at the firm level. Moreover, it is difficult to assess the extent of hedging accurately, due to the complex combination of various hedging tools with different time horizons, payoff profiles, notional amounts, exercise prices, etc., and also due to limited accounting disclosure and time-varying exposures. Finally, most empirical studies classify firms as either hedgers or non-hedgers, without allowing for the possibility that a firm could move between the two groups over time. Such problems limit the power of the tests.

The paper is organized as follows. Section 2 presents various theoretical arguments motivating hedging at the firm level as a source of shareholder value. It also presents the

proxies that can be used to test the theoretical predictions as well as the corresponding exist-

ing empirical evidence. The section ends with a discussion of the empirical challenges and

limitations of empirical tests of risk management theories. Finally, Section 3 provides a

summary and conclusion of the paper.

2   Theory and Evidence of Value Creation through Corporate Risk Management

Basic economic theory seems to imply that corporate risk management cannot contribute to

the creation of shareholder value (see Dufey and Srinivasulu, 1983, for an extensive discus-

sion). For example, according to the Modigliani and Miller (1958) propositions corporate

financing decisions cannot be used to increase firm value in perfect capital markets since

shareholders can easily replicate them. Consequently, since corporate risk management can

be seen as a financing policy, it cannot contribute to firm value creation in an M&M world

(Bartram, 2002; Stulz, 2000; 1996; Smith, 1995; Culp et al., 1994; Mayers and Smith, 1982).

As a result, for corporate risk management to increase firm value it must be the case

that one or more of the assumptions of the M&M framework are violated. In other words, the

benefits of corporate hedging (if they exist) should arise due to capital market imperfections,

which prevent shareholders from being able to perfectly replicate risk management at the

firm level (Stulz, 2001; Fite and Pfleiderer, 1995; Smith et al., 1990).[1] As discussed below,

capital market imperfections that provide positive rationales for corporate risk management

consist e.g. of direct and indirect costs of financial distress, costly external financing, and

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[1] High firm complexity might be another reason for shareholders to be unable to replicate firms' corporate hedging decisions (see Dolde and Mishra, 2007).

taxes. In addition to these firm-specific determinants of corporate risk management, the economic and legal environment of the country a firm is located in may also impact the decision to hedge.

Theories of corporate risk management are typically tested empirically using binary variables that indicate whether a firm uses derivatives or not (e.g., Bartram, Brown and Fehle, 2009; Mian, 1996; Nance et al., 1993), and the use of derivatives is interpreted as an indication of corporate hedging in general.[2] For selected, commodity-based industries (e.g., oil, gold), sometimes more detailed information about the use of derivatives is available, enabling empirical studies to use variables such as (net) notional values of derivatives or the percentage of production hedged, which might more accurately measure the extent of corporate hedging (Lel, 2006; Dionne and Triki, 2005; Haushalter, 2001; 2000; Tufano, 1996).

Most empirical studies relate these proxies for corporate risk management to firm, industry or country characteristics in order to test whether firms with particular properties that according to financial theory should benefit most from corporate hedging are indeed more likely to use derivatives and/or use them to a larger extent (Bartram, Brown and Fehle, 2009; Haushalter, 2000; Tufano, 1996). A large number of different proxies are used to test the

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[2] While derivatives can in principle also be used for speculative purposes, there is some evidence that firms do indeed use derivatives (mostly) for the purpose of hedging, though the evidence is not clear cut. In particular, some studies report few, if any, differences in risk between derivatives users and non-users (Hentschel and Kothari, 2001), or a slight reduction in the risk of firms that initiate the use of derivatives (Guay, 1999). By the same token, results of Tufano (1996) and Allayannis and Ofek (2001) also support the idea of derivatives being used for hedging purposes. In contrast, there is also some, though limited evidence of speculation (market timing) in firms' interest rate risk management practices (Faulkender, 2005). However, several studies indicate that the gains from speculating (or 'selective' hedging) appear small at best (Adam and Fernando, 2006; Brown et al., 2006). In an efficient market, one would expect them to be close to zero (or negative by the amount of transaction costs). Géczy et al. (2007) use survey data on derivatives usage by U.S. non-financial firms to document that firms with weak internal governance structures that allow for greater managerial power and fewer shareholder rights are more likely to indicate in the Wharton survey on derivatives usage that they take a view with derivatives.

underlying theories (Table 1).[3] Moreover, a few studies analyze whether the determinants for

the decision to hedge and the extent of hedging are different (Graham and Rogers, 2002; Al-

layannis and Ofek, 2001), while other studies consider different types of hedging, e.g. ex-

change rate or interest rate risk (Bartram, Brown and Fehle, 2009; Graham and Rogers,

2002), commodity price risk (Géczy et al., 2006; Haushalter, 2000), or alternative risk man-

agement strategies that do not involve derivatives (Petersen and Thiagarajan, 2000).[4]

Some studies investigate the impact of corporate governance on the importance of dif-

ferent rationales for hedging at the firm level (Lel, 2006). To illustrate, managers may use

corporate hedging to increase the utility of their compensation packages particularly in firms

with weak governance. Finally, there are also some studies that more directly test the value

implications of corporate hedging, by relating derivatives use to leverage (Graham and Rog-

ers, 2002) or relative valuation metrics such as the market-to-book ratio (Mackay and Moel-

ler, 2007; Jin and Jorion, 2006; Allayannis and Weston, 2001).[5]

Nevertheless, almost all empirical work in this area faces some significant challenges

that need to be considered when interpreting the results. To illustrate, endogeneity and identi-

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[3] While the studies included in the tables that are discussed in this section are meant to provide a com-
prehensive overview of the empirical evidence on positive corporate risk management theories, the large num-
ber of studies on this subject makes it impossible to include all of them. As a result, some studies are excluded
from the tables, particularly those that largely verify whether results obtained for the United States also hold for
firms in other countries.

[4] Bartram, Brown and Fehle (2009) estimate a (simultaneously estimated) multivariate PROBIT model
for FX, IR, and CP derivatives use, as well as ordered LOGIT models with the dependent variables as either the
number of exposures (FX, IR, and CP) hedged, or the number of derivative types utilized (Forward, Futures,
Swap, and Option).

[5] As discussed in more detail in Section 2.5, there are significant challenges to identifying the effect of
corporate hedging on firm value. To illustrate, market-to-book ratios have been used as dependent variable of
regressions with derivatives use as independent variable to measure the value effects of hedging. Nevertheless,
market-to-book has also been used as a determinant of derivatives use. Since one measures in both cases the
correlation between derivatives use and market-to-book, there exists a potential simultaneous equations problem
that is rarely addressed in the literature.

fication problems, empirical modeling of structural relations, identifying appropriate proxy variables for corporate hedging beyond the use of derivatives, assessing the extent of corporate hedging in the face of multi-faceted hedging strategies and time-varying exposures, are major issues that many studies in this literature fail to address and, thus, potentially severely limit the conclusions that can be drawn from their results.

2.1 Agency Costs

2.1.1 Underinvestment and Asset Substitution Problems

A company can be seen as a nexus of contracts between different parties, such as, e.g., managers, shareholders, creditors, and employees (Jensen and Meckling, 1976). Since managers, who run the company as agents on behalf of shareholders, are more involved in the daily activities of the firm, they enjoy an information advantage over their principals, i.e. shareholders. Given that both groups may not share common goals, conflicts can emerge since it is typically not possible to prevent non-value maximizing behavior via perfect contracts (Fama 1980).

Yet even if managers act in line with shareholders' interests, they still might forgo value-enhancing projects, if the gains of accepting these projects accrue mostly to bondholders (underinvestment problem). This situation arises typically when a firm is highly levered and firm value is low, as bondholders are reimbursed before shareholders, and thus valuable projects might not benefit shareholders. Solutions to this problem, such as, e.g., rewriting or negotiating debt contracts, are often costly and thus impractical (Smith et al., 1990; Myers, 1977).

While the underinvestment problem can be alleviated through reduction of debt outstanding, corporate risk management can achieve the same goal without sacrificing the tax

benefits of debt. This stems from the fact that corporate hedging reduces the volatility of firm value and thus makes it less likely that firm value drops to levels at which there are incentives for shareholders to forgo positive NPV projects (Smith, 1995; Bessembinder, 1991; Smith et al., 1990; Mayers and Smith, 1987).

Further conflicts of interest between shareholders and debtholders can arise, however, as it is usually beneficial for shareholders of a leveraged firm to substitute highly risky investment projects, possibly even with negative NPV, for safe investment project (asset substitution or risk shifting problem). This incentive can be explained by the fact that shareholders' claim on firm value has the properties of a call option on the assets of the firm with the debt value as strike price (Mason and Merton, 1985; Merton 1974). As the value of options increases with the volatility of the underlying asset, shareholders increase the value of their position by replacing safe assets with risky assets.

Since debtholders anticipate this opportunistic behavior, they demand either higher yields on the capital provided and/or protective covenants. Both of these possibilities create additional costs that reduce firm value (Smith and Warner, 1979). Corporate risk management stabilizes firm value and hence reduces the chance that states of the world occur in which shareholders have strong incentives to shift towards riskier assets (Smith, 1995; Campbell and Kracaw, 1990). Thus, if a firm has committed itself to a corporate hedging policy, agency costs are reduced. However, it is difficult for a company to credibly guarantee the continuing existence of corporate hedging, as it might consider discontinuing risk management, if it winds up in a situation in which taking on more risky projects is very beneficial (Stulz, 2001).

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Nevertheless, Morellec and Smith (2007) show that shareholders will typically benefit from negotiating the issuance of debt and the hedging strategy simultaneously, since lenders will provide the same funds at a lower rate. Consistent with this result, many firms appear to arrange credit lines as well as hedging programs through the same financial institution, which enables the bank to monitor the borrowers' hedging programs. Consequently, other financial institutions or contracting parties may also offer more favorable terms to companies that establish lines of credit and hedge positions with the same bank.

Agency problems between principals and agents arise in a world of incomplete contracting and asymmetric information. Variables used in empirical studies to proxy for such information asymmetries are the number (or the percentage) of outstanding shares owned by institutional investors, the number of large blockholders, usually with a stake above five or ten percent, the existence of multiple share classes, the number of analysts following a firm, and analysts' mean accuracy and dispersion in forecasting a firm's earnings. Firms that are owned to a large extent by institutional investors, tracked by a large number of analysts, that do not have multiple share classes, and whose earnings can be predicted with great accuracy and low dispersion face less informational asymmetry, and therefore should be less likely to hedge (DaDalt et al., 2002; Visvanathan, 1998; DeMarzo and Duffie, 1991). In contrast, the hypothesized sign of proxies for large blockholders depends on their diversification level. While a high percentage of well diversified outside blockholders should significantly enhance information availability and reduce incentives to hedge, corporate hedging could also be an effective way for less diversified outside blockholders to reduce their unsystematic risk.

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There is only limited empirical evidence on the relation between corporate hedging and asymmetric information (Table 2). While variables proxying for institutional ownership and analysts following are generally significant, the effect is often not of the predicted direction (Graham and Rogers, 2002; Rogers, 2002; Géczy et al., 1997). Only more recent studies sometimes obtain the predicted association (Dionne and Triki, 2005; 2004). As theory suggests, the existence of multiple share classes leads to higher derivatives' use (Bartram, Brown and Fehle, 2009). Large blockholders are always negatively associated with corporate hedging (Mardsen and Prevost, 2005; Borokhovich et al., 2004; Haushalter, 2000; Tufano, 1996). Thus, if large blockholders are mainly well-diversified shareholders, which may be reasonable to assume, this would represent evidence supporting the asymmetric information argument. Finally, the mean accuracy and the dispersion of analysts' earnings forecasts show significant associations with corporate hedging in the predicted directions (DaDalt et al., 2002).[6]

Underinvestment and asset substitution problems are more important for firms with high growth opportunities, as the value of these firms would suffer most from failing to invest into the available profitable projects, and high leverage, as these firms are more likely to end up in states of nature in which these conflicts can occur.[7] As a result, high growth opportunities and high leverage should increase the incentives for corporate hedging. Proxies which measure the existence and magnitude of available growth opportunities include research and development (R&D) expenditures, property, plant, and equipment (PP&E) expen-

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[6] Demsetz and Lehn (1985) argue that ownership structure is endogenous, giving rise to potentially important simultaneous equations biases for analyses that do not account for these effects.

[7] Since the investment opportunity set is important for both corporate hedging as well as leverage, potentially important endogeneity bias problems exist.

ditures, the asset growth rate, and attempted acquisition activities. For certain industries (e.g., gold, gas, and oil producers), exploration expenditures are used as an alternative proxy. Since these proxies directly measure the resources invested into growth activities, there should be a positive relation between these variables and growth opportunities and, in turn, also a positive relation with corporate hedging (unless these variables also proxy for free cash flow problems).

Other proxies measure the availability of positive NPV projects in a more indirect way, such as the earnings-to-price and the book-to-market ratio. A lower book-to-market ratio indicates higher availability of growth opportunities, suggesting a higher propensity to hedge. Similarly, firms with currently low earnings yet high share price appear to derive most of their firm value from profitable prospective expansion opportunities. Therefore, the earnings-to-price ratio and corporate derivatives' use should be negatively related. Finally, an increase in a firm's growth opportunities is expected to lead to significant cumulative abnormal returns (CARs) (Gay and Nam, 1998). As a result, companies with high CARs should be more inclined to hedge.

Regulated industries are often characterized by lower levels of information asymmetries than other industries (Mian, 1996). Hence, it is easier for creditors to monitor the behavior of managers, and thus to inhibit them from shifting risk or turning down profitable investment projects. Furthermore, it can be argued that regulated industries in general, first, do not enjoy the same growth opportunities as unregulated industries and, second, operate in more stable environments (Smith and Watts, 1992). It can thus be hypothesized that firms in regulated industries have a lower demand for corporate hedging than firms in unregulated industries.

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Empirical results strongly support the hypothesized relation between R&D expenditures and corporate risk management (Table 3) (Lin and Smith, 2007; Knopf et al., 2002; Allayannis and Ofek, 2001; Gay and Nam, 1998; Howton and Perfect, 1998; Fok et al., 1997; Géczy et al., 1997; Dolde, 1995; Nance et al., 1993). At the same time, the coefficients of PP&E expenditures, the asset growth rate, and the value of attempted acquisitions never have the correct sign at any conventional significance levels. Only one study finds the predicted relation between high exploration activities (in the gold mining industry) and derivatives' use (Rajgopal and Shevlin, 2002), while the evidence in other studies is either insignificant or in the opposite direction (Dionne and Triki, 2005; Haushalter, 2000; Tufano, 1996), which may be due to the relation between growth options and corporate hedging being more complex than conjectured in these empirical studies (Morellec and Smith, 2007).

With regards to the more indirect measures of growth opportunities, the earnings-to-price ratio, which is mainly used in earlier studies, offers some support for the agency cost hypothesis in multivariate tests (Gay and Nam, 1998; Berkman and Bradbury, 1996). Moreover, while hypotheses related to book-to-market are often not validated, CARs associate with corporate hedging at significant levels in the right direction (Gay and Nam, 1998). Finally, there is strong evidence suggesting that firms in regulated industries face lower incentives to engage in corporate hedging (Rogers, 2002; Mian, 1996).

The evidence partially supports the hypothesis that financial constraints concurrent with growth opportunities lead to a higher propensity for corporate hedging. These tests are based on interaction variables, such as the debt ratio multiplied with either the market-to-

book ratio or R&D expenditures.[8] Since large growth opportunities and high financial lever-age increase the value of this interaction term, a positive relation between the interaction term and corporate risk management should be expected. Although this can be confirmed for the interaction term with the market-to-book ratio, no evidence is found for the interaction term based on R&D expenditures (Bartram, Brown and Fehle, 2009; Graham and Rogers, 2002; Géczy et al., 1997). Lastly, the positive association between corporate hedging and the interaction term of leverage with the market-to-book ratio appears to be conditional on strong corporate governance structures (Lel, 2006).

Furthermore, the simultaneous effect of financial leverage and growth opportunities on corporate hedging can be tested by controlling for differences in cash ratios. By adding a cash dummy to the OLS regression, the evidence supports hypotheses related to the earnings-to-price ratio, R&D expenditures, and CARs (Gay and Nam, 1998). Overall, however, the empirical support for theories of motives for corporate hedging based on agency costs of debt are mixed at best.

2.1.2 Management Compensation, Incentive Structures, and Risk Preferences

Managers and shareholders might also have divergent interests, because managers like to spend cash on perquisites when the proportion of managerial ownership in a company is low. In addition, managers likely consider their personal attitudes towards risk when choosing the company's level of risk, which may not perfectly match shareholders' preferences (May, 1995; Smith and Stulz, 1985). While active monitoring can prevent managers from behaving in non-maximizing ways, no single shareholder has strong incentives to engage in monitor-

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[8] Note that it is not clear that this approach is an adequate method to deal with the endogeneity issues.

ing, as the gains accrue to all other investors in case ownership is widely dispersed and monitoring is costly (free-rider problem). Large shareholders, however, such as institutional investors, have higher incentives to exercise careful vigilance, since they are not only bearing the costs, but also obtain a significant part of the benefits. Still, there are disadvantages to holding large blocks of shares in one company, such as foregone diversification benefits (Markowitz, 1952).

Often, management has an undiversified wealth position in a firm due to current and future income and non-monetary utility components, such as reputation, awards, and promotions. As managers' welfare is strongly related to the ongoing existence of the business, managers might be inclined to reduce the firm's risk characteristics to levels conflicting with shareholder value maximization or, alternatively, to demand higher compensation for being exposed to high business risk (Mayers and Smith, 1990; Stulz, 1990; 1984).

Risk management at the firm level can make it more attractive for undiversified investors to hold large equity-blocks by reducing idiosyncratic risk. As concentration among shareholders increases, so does monitoring, leading to more efficiently managed businesses and, in turn, higher cash flows (Stulz, 2001; Fite and Pfleiderer, 1995). With regards to management, corporate hedging might lower the variability and thus the level of compensation required by managers by decreasing firm-specific risk (DeMarzo and Duffie, 1995). Moreover, it might lower managers' incentives to pursue more costly diversification strategies, like operative diversification of businesses (Bodnar et al., 1997; Berger and Ofek, 1995; Comment and Jarrell, 1995).

In addition to monitoring, managerial incentive packages are often used to align the interests of principals and agents by providing managers with incentives to focus on share-

holder value. Consequently, managerial compensation is often tied to a firm's stock price. Compensation and stock price can be linked linearly, as in case of managerial share programs, for which changes in firm value translate in a linear fashion into changes in compensation.[9] As managers are, however, more risk-averse than shareholders due to their undiversified wealth position, share programs induce managers to reduce firm-specific risk even further. In contrast, non-linear incentive structures, like stock option programs, offer more than proportional benefits for increases in firm value, creating a convex payoff scheme. Therefore, non-linear compensation packages might, contrary to share programs, provide incentives for managers to bear more risk.

Nevertheless, when management compensation is tied to the stock price, changes in compensation are sometimes unrelated to managers' decisions, but are due to general market fluctuations, thus exposing managers to uncontrollable systematic risk. This might entail dysfunctional behavior, such as managers hurting firm value to lower their exposure (Stulz, 2001). Moreover, the distinction between high- and low-qualified managers becomes blurred when management performance is distorted by non-core business risks. Consequently, corporate risk management can add value by alleviating the impact of market fluctuations on firm value, thus helping to distinguish between efficient and inefficient managers (Bartram, 2000; Campbell and Kracaw, 1987). In addition, a strengthened correlation between managerial

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[9] Note that the equity of a levered firm is like an option on the assets of the firm. In this sense equity also has a convex payoff structure, but less than a stock option. Note also that companies typically provide compensation packages that include both company stock as well as stock options. One can think of a CEO's salary as a contingent bond that makes coupon payments (salary) on a regular basis with some underlying uncertain principal (severance) that would be paid upon termination/retirement. If a firm goes bankrupt, the manager probably gets no severance payment, he loses the firm-specific human capital component, and it is (empirically) unlikely that he would be a CEO at another company. The value of this set of cash flows (bond) is greater the longer its expected maturity (time to termination), though big severance packages that are being paid may make that a questionable assumption. Finally, another way to think about executive compensation is as an annuity with a down-and-out barrier trigger that terminates the annuity at certain equity prices. This will not have a positive vega in all price states and so changes the standard implications for risk taking.

performance and shareholder value renders incentive programs more efficient tools for stimulating managers to focus on shareholder value.

Theory models that examine agency conflicts between shareholders and bondholders as well as between shareholders and managers simultaneously can lead to richer predictions than discussed so far. For instance, Morellec and Smith (2007) argue that corporate hedging can also control free cash flow problems. Thus, more growth options increase underinvestment problems, but also imply fewer free cash flow problems because of fewer assets in place. Corporate risk management lowers the probability of both high and low cash flows, and thus reduces the costs of both overinvestment as well as underinvestment.

Given the potential of corporate hedging to reduce the unsystematic risk of the firm, it can be argued that the amount (or percentage) of outstanding shares owned by large, ill-diversified investors should be higher for firms that use derivatives. Hence, variables indicating the existence of blockholders other than managers or directors who hold shares in excess of 5% or 10% are used in some empirical studies. Contrary to theoretical predictions, this variable is generally negatively associated with corporate hedging (Table 4) (Haushalter, 2000; Tufano, 1996). This result could be driven by the fact that the proxy used does not distinguish between diversified and ill-diversified investors, while the hypothesized effect pertains to investors that are not well diversified. Therefore, it could be sensible to use proxies that measure large blockholdings of more than 5% or 10% of shares *and* distinguish between different types of investors.

Early empirical studies investigate the effect of management compensation packages on corporate hedging policies by analyzing the amount (or fraction) of shares and options held either by the CEO or by all directors and managers. In particular, these studies argue

that for firms that award company shares, managers face incentives to hedge more, and thus these variables should be positively correlated. Executive stock option programs, on the other hand, should be negatively associated with corporate risk management, as corporate hedging decreases the volatility of firm value, and therefore the value of stock options.

These arguments, however, can be criticized on the grounds that they ignore the fact that management share and option programs can have different sensitivities of value towards changes in share price and volatility. For example, strike prices of management option plans are often set close to the market price, so that even modest performance moves them in-the-money (Gay and Nam, 1998). More interestingly, anecdotal evidence suggests that deep out-of-the-money options are in many cases replaced with at-the-money options (Browning and Jereski, 1997).[10] These stock option plans therefore generate incentives similar to share programs. To overcome these issues, some studies employ the sensitivities of the value of the CEO portfolio with respect to changes in stock price and volatility, calculated with the Black-Scholes (1973) formula (Lel, 2006; Graham and Rogers, 2002; Knopf et al., 2002).

Since inefficient and low-qualified managers benefit from the fact that non-business risks distort the relation between corporate performance and management skills, they have incentives to avoid corporate risk management (Breeden and Viswanathan, 2006). Also, if younger managers work harder than older managers and are motivated to build a strong reputation, an officer's tenure can be used as a measure to test for divergent interests between efficient and inefficient managers (Tufano, 1996). Besides an officer's tenure, a manager's educational background could also influence his corporate hedging policy (Dionne and Triki, 2005).

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[10] Given recent changes in regulations, this has become much less likely.

The empirical evidence for the absolute value (or percentage) of shares owned by the CEO or directors and managers is overall mixed (Table 4) (Mardsen and Prevost, 2005; Dionne and Triki, 2004; Haushalter, 2000; Gay and Nam, 1998; Géczy et al., 1997; Berkman and Bradbury, 1996; Tufano, 1996). Studies examining the sensitivity of the CEO portfolio towards changes in the share price in general find more supportive results (Graham and Rogers, 2002; Knopf et al., 2002). Additionally, the significant negative association between officers' tenure and risk management provides evidence for the relevance of management qualification (Tufano, 1996). Last but not least, it seems that only firms with weak corporate governance use derivatives to hedge the risks associated with executive stock plans (Lel, 2006).[11] Potential management performance indicators that could be considered in future research to control for management quality when testing the relations between derivatives use and company stock programs for management are economic value added (EVA), economic profit (EP), or cash value added (CVA).

There is also significant evidence for differences in managerial option holdings of companies using derivatives and those which do not, although the relation differs across analyses (Bartram, Brown and Fehle, 2009; Dionne and Triki, 2004; Haushalter, 2000; Gay and Nam, 1998; Géczy et al., 1997; Tufano, 1996). Studies examining the sensitivity of the CEO portfolio towards changes in volatility find the theorized association in all but one case at conventional significance levels (Graham and Rogers, 2002; Knopf et al., 2002; Rajgopal and Shevlin, 2002; Rogers, 2002). Again, this association appears conditional on the corporate governance structure of the firms analyzed (Lel, 2006). In conclusion, hypotheses related

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[11] Note that governance measures may also be endogenous, inducing a potential simultaneous equations bias.

to agency conflicts between shareholders and managers are often only weakly confirmed as motives for value creation through risk management at the firm level.

2.1.3 Coordinating Investment and Financing Policies

Risk management at the firm level can increase firm value by aligning corporate investment and financing policies. As future cash flows are uncertain, internal funds that are used to finance growth opportunities often vary significantly. As a result, in situations in which internal funds are insufficient to finance all positive NPV projects, a firm is either forced to cut back on its investment plan or to raise external equity or debt.

External capital, however, is costly due to agency conflicts. More specifically, as creditors incorporate their expectations about bankruptcy and financial distress into their lending decisions, a non-zero probability of default induces them to demand higher yields on the company's debt. Although this enables them to obtain a fair value from their investment, it increases the firm's cost of debt and thus decreases firm value (Myers, 1993; 1984). Another way to protect their claims consists of covenants which restrict managerial decision-making with respect to financing and investment policies. These covenants can, however, also prove value reducing if they turn out ex post to deter managers from following sound investment projects (Bartram, 2000).[12] Similarly, the issuance of new equity has a negative effect on firm value, as investors anticipate incentives of management to issue new stock when it is overvalued (Asquith and Mullins, 1986).

Because of these costs of external capital, firms more often cut back on their investment expenditures than turn to financial markets, thereby foregoing profitable investment

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[12] Note that if covenants are chosen rationally, this cost is expected to be less than the expected benefits of controlling debt-related costs (Smith and Warner, 1979).

projects. In fact, the empirical evidence suggests that higher cash flow volatility may lead to permanent cutbacks in investment (Minton and Schrand, 1999). Corporate hedging can ensure that firms have sufficient internal funds to finance their profitable growth opportunities without having to raise outside capital – which however also reduces the discipline that capital markets impose on managers (Chang, 2000; Tufano, 1998). Moreover, firms exhibiting a strong natural association between the availability of and need for internal funds should face lower incentives to hedge (Spanò, 2001; Moore et al., 2000; Copeland and Copeland, 1999; Mello and Parsons, 1999; Fite and Pfleiderer, 1995; Santomero, 1995; Froot et al., 1994; 1993; Lewent and Kearney, 1990).

Similar to the asset substitution and the underinvestment problem, the coordinated financing and investment hypothesis depends upon the existence of cash flow constraints and available growth opportunities in the presence of capital market frictions. As a result, the same proxies can be employed to test this hypothesis. Moreover, it can be investigated whether companies with a greater correlation between available and needed funds hedge less frequently than companies with a lower correlation. The existing evidence strongly supports this hypothesis (Gay and Nam, 1998). Likewise, there is strong support for the hypothesis that companies using derivatives exhibit a lower sensitivity of investment to pre-hedging cash flows (Allayannis and Mozumdar, 2004). In contrast, there is also evidence that the effect of derivatives use on cash flows is small (Guay and Kothari, 2003). Indirect evidence supporting this theory is found in Géczy et al. (1997), while direct evidence can be found in Minton and Schrand (1999).

2.1.4 Costs of Bankruptcy and Financial Distress

Levered companies run the risk that their cash flows are not sufficient to meet all fixed payment obligations timely and in full. This risk increases with higher leverage or more volatile cash flows. A company that is unable to fulfill its fixed payment obligations is forced into bankruptcy, at which point creditors and shareholders try to recover their investments in the firm. However, although creditors are holders of priority claims, there is often a costly dispute about the actual distribution of residual firm value (Warner, 1977a).

Furthermore, even before a company is actually filing for bankruptcy, it may encounter indirect costs of bankruptcy, if insolvency is expected in the near future. These costs are due to the reluctance of suppliers and customers to deal with the company, a distraction of management attention, risk premia reflected in higher management and employee compensation, etc. Direct costs of bankruptcy accrue in the actual bankruptcy procedure and pertain mainly to lawyers' charges, administrative and accounting fees, and expenses for expert witnesses. On average, direct costs of bankruptcy are usually only in the order of 1% to 3% of shareholder value (Weiss, 1990; Warner, 1977b). In contrast, indirect costs tend to be much larger than direct costs and can approach 20% of company value (Cutler and Summers, 1988).

The expected costs of financial distress stem mostly from low levels of company value, i.e. they are the product of the probability of these states of nature times the actual costs. As corporate risk management decreases the likelihood of reaching these left-tail realizations by reducing the volatility of firm value, it lowers the expected costs of financial distress (Stulz, 2001; Raposo, 1999; Santomero, 1995; Dolde, 1993; Rawls and Smithson, 1990; Smith et al., 1990; Mayers and Smith, 1982). However, corporate risk management increases firm value even further by enabling firms to carry more debt. In other words, by increasing the optimal

debt-equity ratio, it allows firms to enjoy greater tax shields (Graham and Rogers, 2002; Leland, 1998).

Given that corporate risk management can lower the present value of bankruptcy and financial distress costs, firms with a high probability of default and/or high financial distress costs should be more likely to engage in corporate hedging. This hypothesis can be tested using the long-term debt ratio and the interest coverage ratio, which both give an indication of the probability of financial distress. A firm with high leverage has higher payment obligations, and should therefore be more likely to experience difficulties in honoring these commitments. It thus might have stronger incentives to hedge. In the same vein, the interest coverage ratio should be negatively associated with corporate hedging, since a higher interest coverage ratio suggests more pre-tax income to satisfy committed payments.

The use of the long-term debt ratio is not without controversy. If financial distress costs do not only depend on a firm's debt ratio, but also on other industry-specific, exogenous factors (such as the level of competition, rivalry, etc.), a firm with high distress costs might have a low debt ratio, and still face high incentives to hedge. A modified financial distress proxy subtracts the industry's median leverage ratio from the firm's leverage ratio, and a debt ratio above-industry level would indicate a high probability of distress (Géczy et al., 1997). Furthermore, it is possible that high leverage only leads to default in combination with a lack of available cash. A potentially better, more forward looking proxy for the default risk of a firm would consist of the default probability implied in the firm's stock or option price (Bartram et al., 2007; Vassalou and Xing, 2004; Merton, 1974). As mentioned before, important endogeneity problems exist with regards to financial leverage and derivatives use, since high

leverage might induce more hedging, but hedging also allows for a larger debt ratio with concomitant increases in tax shields.

As cash and marketable securities can be used to cover financial obligations, particularly short-term liabilities, higher short-term liquidity should result in a lower need for hedging. By the same token, companies that are paying high dividends have few incentives to hedge, as it can be argued that only highly liquid firms can commit themselves to paying out dividends. In contrast, if firms exhaust their liquidity by paying dividends, they might have incentives to hedge. Preferred stock and convertible debt may constrain firms financially and thus create greater distress costs (Géczy et al., 1997). Alternatively, they could be a means to control the firm's agency conflicts and could thus act as substitutes for corporate risk management with derivatives (Nance et al., 1993), so that the direction of the relation of these variables with derivatives use is an empirical question. Moreover, there are also potentially important endogeneity biases with regards to dividend policy that complicate the analysis (Smith and Watts, 1992).

Other market participants' assessment of a firm's survival chances might also help to proxy for the probability of bankruptcy and financial distress. More specifically, credit ratings and the credit risk spread, i.e. the yield difference between a firm's bonds and 10-year Treasury notes, contain important information about a firm's financial risk. Firms with low credit ratings and high credit risk spreads should face a higher probability of distress, and they should thus be more inclined to use corporate hedging.

By the same token, a firm's profitability might also be a determinant of its corporate hedging policy, since less profitable companies likely have more difficulties in meeting their fixed payment obligations and thus run a higher risk of insolvency. As a result, these firms

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will hedge more than more profitable firms. Popular measures of profitability are gross margin, sales, and the return on assets (ROA). Since the presence of tax-loss carry-forwards indicates the existence of net losses during at least one of the last years, tax-loss carry-forwards should also be positively associated with corporate risk management. Furthermore, production costs can be used to make inferences about the likelihood of financial distress, since, as a rule of thumb, for many firms financial distress becomes serious when prices drop below production costs, which is more likely to happen for firms with high production costs (Tufano, 1996).

Several studies employ discriminant analysis to predict the likelihood of a firm's bankruptcy. Firms with higher predicted probabilities of future bankruptcy, e.g. based on Z-scores (Altman, 1983), should be more inclined to hedge. Moreover, financial distress costs are a function of the extent of intangible assets. As tangible assets can be easily sold in case of bankruptcy, firms with a high proportion of tangible assets should have a lower level of financial distress costs than firms with significant intangible assets. Since the costs of financial distress are not proportional to firm size (Warner, 1977b), small firms have higher distress costs (as a fraction of firm value). Similarly, firms with large advertising and selling, general, and administrative (SG&A) expenses often have more unique products that are harder to liquidate quickly.

The long-term debt ratio and the interest coverage ratio are widely used to test the financial distress hypothesis. Despite the discussed potential endogeneity problems, most studies obtain a significant positive relation between the long-term debt ratio and corporate hedging (Table 5) (Bartram, Brown and Fehle, 2009; Dionne and Triki, 2005; Graham and Rogers, 2002; Haushalter, 2000; Guay, 1999; Gay and Nam, 1998; Howton and Perfect,

1998; Fok et al., 1997; Berkman and Bradbury, 1996; Mian, 1996). This association, however, seems to be only significant for firms with strong corporate governance structures (Lel, 2006). As different risk levels could distort the hypothesized relation between corporate hedging and the long-term debt ratio, it might be important to control for risk exposure (Dolde, 1995). After sorting sample firms into groups of similar primitive risk, the evidence strongly supports the predicted relation between corporate hedging and debt levels.

The evidence also strongly suggests that users of derivatives exhibit lower short-term liquidity than those without derivatives (Lin and Smith, 2007; Allayannis et al., 2003; Dionne and Garand, 2003; Fok et al., 1997; Géczy et al., 1997; Tufano, 1996). With respect to dividends (or dividend yields), however, no clear pattern emerges, i.e. while many studies obtain significant results, the relation varies across analyses (Bartram, Brown and Fehle, 2009; Dionne and Garand, 2003; Haushalter, 2000; Berkman and Bradbury, 1996; Mian, 1996). Similarly inconclusive results obtain for preferred stock and convertible debt, as these proxies are often insignificant at conventional levels (Gay and Nam, 1998; Fok et al., 1997).

To control for endogeneity in the choice of capital structure and hedging, these decisions can be modeled simultaneously. The results of simultaneous equation models largely confirm a significant positive association between debt levels and hedging (Bartram, Brown and Fehle, 2009; Graham and Rogers, 2002; Géczy et al., 1997). This is evidence for increased firm value via tax benefits of debt. For oil and gas producers, firms using derivatives show higher leverage ratios and lower current ratios than the industry median at the 1% significance level (Haushalter, 2000). Finally, although the sign is sometimes in the predicted direction, the interest coverage ratio is often insignificant at conventional levels (Howton and Perfect, 1998; Fok et al., 1997; Berkman and Bradbury, 1996).

The remaining variables generate mixed results. For example, the evidence on credit ratings and production (or cash) costs is always significant with the correct sign (Dionne and Triki, 2004; Dionne and Garand, 2003; Haushalter, 2000). In univariate analyses, all three profitability measures indicate that counter to theory more profitable companies hedge more, while they are sometimes positively and sometimes negatively associated with derivatives use in multivariate tests. The evidence on tax-loss carry forwards is mixed, and will be examined more carefully in the next section.

With regards to the size of financial distress costs, firms using derivatives show lower ratios of tangible assets to total assets than firms not using derivatives (Howton and Perfect, 1998). In contrast, the evidence for variables proxying for the uniqueness of a firm's products appears weak (Dolde, 1995). Moreover, the evidence suggests that large firms face stronger incentives to hedge than small firms, and thus seems to indicate that corporate hedging exhibits significant economies of scale. However, there exists some evidence that the extent of corporate hedging and firm size are negatively related, i.e. for firms having a risk management program in place small firms hedge more than large firms (Graham and Rogers, 2002; Allayannis and Ofek, 2001; Haushalter, 2000). Results using the Z-score are similar (Francis and Stephan, 1990). In summary, there is some evidence suggesting that bankruptcy and financial distress costs are important determinants of corporate hedging, but the evidence is not entirely unambiguous.

2.2 Corporate Taxes

If the tax schedule is convex, i.e. if taxes increase more than proportionally with taxable income, volatile taxable income results in a higher tax burden than stable pre-tax income. To the extent that corporate hedging stabilizes taxable income, it creates value since savings

from higher income states exceed additional taxes from lower income states, thus lowering the average corporate tax burden (Stulz, 2001; Bartram, 2000; Graham and Smith, 2000; 1999; Santomero, 1995; Smith, 1995; Kale and Noe, 1990; Mayers and Smith, 1990; Rawls and Smithson, 1990; Smith et al., 1990; Smith and Stulz, 1985).

Convexity in the tax schedule can be attributed to the influence of statutory progressivity. However, statutory progressivity is relatively limited in most tax systems (Mayers and Smith, 1990). In addition, indirect effects can give rise to convex tax functions. Most often, these indirect effects come through special tax preference items, explicitly tax-loss carryforwards and/or investment tax credits, which are subject to restrictive rules and regulations. As a consequence, in states of low income or losses firms are not able to fully utilize the benefits of these effects (MacKie-Mason, 1990).[13] Given the potential for corporate risk management to reduce the tax burden, firms with more income in the convex region of the tax code or with more special tax items, should have stronger incentives to use derivatives to hedge. Consequently, proxies to analyze this hypothesis either focus on income in the convex tax region or on special tax items.

Taxable income, possibly averaged over several years, is typically used to assess whether the taxable income of a firm is in the convex region of the tax schedule. A more appropriate proxy is to construct a 95% confidence interval around current earnings (Howton and Perfect, 1998). If this interval overlaps with the convex tax region, a firm is assumed to face convexity in its tax code. As tax schedules in most countries are convex up to the highest marginal tax rate and then become linear, a low tax rate indicates a stronger impact of convexity. Finally, the most elaborate and accurate procedure is to compute the tax savings

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[13] Results in Graham and Smith (2000) suggest that the effect of these factors is small, however.

(or increases) from a 5% reduction in income volatility. Under convex tax regimes, volatility reductions lead to tax savings. Other proxies are scaled measures of tax-loss carry-forwards, foreign tax credits or investment tax credits. Alternatively, in order to avoid scaling problems, a dummy variable can denote the availability of tax preference items.

Overall, the empirical evidence based on a tax code progressivity dummy indicating income in the convex tax region provides support for the tax hypothesis (Table 6) (Haushalter, 2000; Howton and Perfect, 1998; Nance et al., 1993). In contrast, marginal (or average) tax rate proxies can lead to significant results, but in the wrong direction (Haushalter, 2000). There is, however, some evidence to support the tax hypothesis when the tax savings from volatility reductions are considered (Dionne and Triki, 2005; Dionne and Garand, 2003). This might be explained by the fact that the tax incentive to hedge in order to increase leverage is larger than the tax incentive of progressivity (Graham and Rogers, 2002; Graham and Smith, 1999). Scaled values and dummies for tax preference items generally lead to qualitatively similar findings. In the majority of cases, tax-loss carry-forwards do not significantly associate with corporate hedging. In contrast, tax credits provide (stronger) incentives to engage in financial risk management (Bartram, Brown and Fehle, 2009; Dionne and Garand, 2003).

In sum, there is some, albeit weak empirical support for the tax hypothesis. The difficulties of finding empirical support for this hypothesis might be due to the fact that the tax incentives to hedge are relatively small compared to other incentives and might thus be hard to identify in statistical tests. It is also possible that firms with the strongest convexity in their tax code are small firms with zero expected income. Last but not least, income volatility can be reduced by other means than corporate risk management (Graham and Rogers, 2002).

2.3 Country-specific Determinants of Hedging

Decisions of firms to engage in risk management may not only be determined by firm characteristics, but the characteristics of the country they are located in may provide additional factors that impact hedging at the firm level. In particular, firms located in economies with more developed and liquid derivatives markets may hedge more because they have greater access to derivatives and thus can hedge more cheaply. The legal system might also affect corporate hedging. In countries with strong legal systems, the costs of contracting might be low, thus facilitating corporate derivatives' use. In contrast, it could be the case that the gains from corporate hedging might be higher in countries with weak legal systems due to higher direct bankruptcy costs, rendering corporate hedging more valuable. At the same time, shareholders can easily replace managers as a result of weak firm performance in countries with stronger shareholder rights, thus creating an incentive for managers to hedge against weak firm performance caused by financial risk. In a different vein, firms located in smaller economies that tend to be less stable may have stronger incentives to engage in hedging. By the same token, firms in economies with high economic, financial, and political risk are likely to exhibit higher derivatives' use (Bartram, Brown and Fehle, 2009; Bodnar et al., 2003).

While country-specific determinants of derivatives' use at the firm level have so far not been widely examined, it appears that the size of a country's local derivatives market associates positively and significantly with a firm's hedging decision, which is consistent with the costs of hedging being lower in more liquid derivatives markets. Moreover, firms headquartered in countries facing high financial and economic risks usually hedge more, since they face larger exposures, while firms headquartered in countries with high political risk tend to employ corporate risk management less frequently. The evidence on other country-specific theories is mixed at best (Bartram, Brown and Fehle, 2009).

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2.4 Direct Evidence of Value Creation through Corporate Risk Management

An alternative to testing whether firms for which theory suggests that they have large incentives to hedge employ corporate risk management more frequently than firms with low incentives is to directly test for the impact of corporate hedging on firm value, often measured by relative valuation metrics such as market-to-book.[14] The empirical evidence provides some support for an increase of shareholder wealth through corporate risk management, for instance by approximately 4% for a large sample of U.S. firms with exchange rate exposure (Allayannis and Weston, 2001) and 12-16% for a sample of firms belonging to the U.S. airline industry (Carter et al., 2006). Moreover, there is some evidence that the value impact of corporate risk management might depend on corporate governance structures, i.e. there seems to be a positive value impact only in countries with strong corporate governance (Allayannis et al., 2004).

In contrast, other studies either find insignificant value effects, or even that corporate hedging decreases firm value (Guay and Kothari, 2003; Nguyen and Faff, 2003). Nevertheless, these tests potentially suffer from difficulties of correctly specifying the empirical tests. To illustrate, it might be the case that the supportive evidence in previous studies is driven by the fact that derivatives' use proxies for other firm attributes which are known to affect shareholder wealth (Lookman, 2003). Again, there is additional evidence from more detailed data available for commodity-based industries. In particular, a recent study investigates the hedging activities of 119 U.S. oil and gas producers from 1998 to 2001 and evaluates their

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[14] The literature often refers to this ratio also as Tobin's Q. Note that Tobin was trying to identify a macroeconomic investment function and argued that a firm should invest to the point where market value/book value = 1. Note also that the valuation measures that are typically being used in empirical tests for value effects of corporate hedging are average ratios, not marginal ones as suggested by Tobin. We thank Clifford W. Smith, Jr., for pointing this out.

effect on firm value, based on detailed information on the extent of hedging and on the valuation of oil and gas reserves (Jin and Jorion, 2006). While hedging reduces the firms' stock price sensitivity to oil and gas prices, hedging does not seem to affect the market value of firms in this industry. The evidence of studies directly analyzing the value impact of corporate hedging is thus fairly mixed and inconclusive to date as well, suggesting the need for further empirical, and possibly theoretical, analysis on this issue.

As often in corporate finance, empirical tests of value effects of corporate hedging are plagued by endogeneity problems, i.e. firm value determines the hedging choice, rather than hedging determining value. Several papers have dealt with these issues in various ways, such as simultaneous equations models (Bartram, Brown and Fehle, 2009; Graham and Rogers, 2002), or sample selection (Jin and Jorion, 2006; Guay, 1999). Bartram et al. (2006) study a global sample of 6,896 non-financial firms from 47 countries. Controlling for endogeneity using several different techniques, they find strong evidence that the use of financial derivatives reduces firm risk as well as some evidence that derivative use is related to higher firm value (as measured by market-to-book).

In summa, the comprehensive analysis of positive theories of value creation through corporate risk management and the corresponding extensive body of empirical evidence suggests as a bottom line that these theoretical arguments are rather unsuccessful in determining derivatives use by non-financial firms. This main conclusion, however, is consistent with arguments and evidence presented in Bartram, Brown and Fehle (2009) suggesting derivatives use as part of the financial strategy of the firm, taking into account the type and level of financial risks, the availability of risk management tools, and the operating environment of the firm. In particular, the evidence suggests that derivatives use is related to debt levels and

maturity, dividend policy, holdings of liquid assets, and the degree of operating hedging. At the same time, corporations do not just use financial derivatives, but rely heavily on pass-through, operational hedging, and foreign currency debt to manage financial risk (Bartram, Brown and Minton, 2009; Guay and Kothari, 2003; Kedia and Mozumdar, 2003). As a result, the impact of financial risk, such as unexpected changes in exchange rates, on non-financial firms is generally small, after accounting for the effect of different forms of hedging, as evidenced by low fractions of firms with significant foreign exchange rate exposure (see e.g. Jorion 1990)[15]. At the same time, the hedging decisions of firms may be influenced by what other firms in the same industry do, as an unhedged firm's foreign exchange exposure increases with the extent of hedging in the industry (Nain, 2004).

2.5 Challenges and Limitation of Empirical Tests

Empirical tests of positive theories of corporate risk management are challenging. Consequently, the results of empirical studies are subject to various caveats and limitations that are important to consider when interpreting the findings.[16] As mentioned above, most empirical studies do not account for the endogeneity of variables describing different dimensions of corporate financial policy and strategy. To illustrate, empirical studies typically use measures of investment opportunities, leverage, debt maturity, dividends, executive stock options, cash holdings, Altman's Z-score, ownership concentration, governance index, etc., which are all endogenous at some level. As a result, the overwhelming majority of the available empirical evidence suffers from a serious simultaneous equations bias (Guay, 1999).

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[15] See Bartram and Bodnar (2007) for a review of the extensive literature on foreign exchange rate exposure.

[16] We are indebted to Clifford W. Smith, Jr., for emphasizing the discussion in this section.

Moreover, a fundamental identification problem rears its head in this context. To illustrate, it is challenging to find empirical proxies of determinants of corporate hedging that are not at the same time also determinants of other corporate finance dimensions such as leverage, compensation or payout policy, and vice versa. Worse, it is not clear that financial theory is as yet rich enough to resolve this problem. For example, most determinants of leverage are also important for hedging decisions (Graham and Rogers, 2002). Only few, recent studies have tried to address these issues, while many studies do not recognize the problem, let alone employ statistical methods, such as simultaneous equations models and structural corporate finance models, that may allow alleviating the problems and take a step towards yielding unbiased estimates of the underlying structural parameters.[17]

It is also important to appreciate that there are variables whose impact on risk management is non-linear. A number of papers argue, for example, that the firm's investment opportunity set affects its hedging incentive, since more growth opportunities imply bigger underinvestment problems, and higher costs imply stronger motives to hedge. But more assets in place (i.e. fewer growth opportunities) entail also bigger free cash flow problems, which mean stronger incentives to hedge (Morellec and Smith, 2007). A detailed understanding of the underlying structural parameters is required in order to be able to capture these effects properly in empirical analyses. Moreover, financial theory does not clearly indicate that these firm-specific parameters are appropriately estimated using cross-sectional data.

In addition, existing theories pertain to the economic motives of financial risk management or hedging in general. Nevertheless, empirical tests frequently focus only on one

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[17] Papers that use simultaneous equations models or other techniques to control endogeneity include Bartram, Brown and Fehle (2009), Bartram et al. (2006), Jin and Jorion (2006), Graham and Rogers (2002), Guay (1999).

single dimension of risk management, namely on the use of financial derivatives, to proxy for hedging at the firm level. In contrast, firms typically use a whole range of coordinated risk management instruments, including foreign currency debt, operational hedging measures, and pass-through. However, there is only limited analysis of the choice between hedging with different instruments (such as foreign currency derivatives or foreign currency debt).[18] To illustrate, a company may have an exposure and a strong motive to hedge, but might do so using hybrid debt instruments (e.g. foreign currency debt, which can be decomposed into a domestic bond plus an embedded currency derivative) instead of (stand-alone) derivatives. In fact, very little of the theory is developed at a sufficient level of detail to specify the particular hedging instrument that should be used (Bartram, 2006; Gay et al., 2003; Brown and Toft, 2002).

In general, the actual extent of hedging by corporations is extremely difficult to assess. This is true not only with regards to the fact that firms use a portfolio of different risk management measures. Even with regards to just the use of financial derivatives, the extent of hedging is hard to quantify.[19] Beyond potential limitations of accounting disclosure, exposures of firms vary over time, and so does the size of their hedges for each horizon into the future. Firms effectively hold (and roll over) portfolios of derivatives with different payoff profiles (linear and non-linear), notional amounts, expiration dates, exercise prices, etc., and the combined effect of this portfolio on the risk profile of the firm is hard to assess, since hedging metrics like deltas depend on the prices at which they are evaluated. Finally, most empirical studies classify firms as either hedgers or non-hedgers, without allowing for the

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[18] Mello et al. (1995) examine the role of operational hedging and its relation to financial hedging, while Bodnar et al. (2002) consider operational hedging and pass-through.

[19] See, for instance, Guay and Kothari (2003).

possibility that firms could move between the two groups over time. These data problems limit the power of empirical tests in this area.

3 Summary and Conclusion

Although corporate risk management cannot increase shareholder value in an M&M world, hedging at the firm level can create value to the benefit of shareholders in the presence of real world capital market imperfections, such as direct and indirect costs of financial distress, costly external financing, and taxes. This paper carefully compiles, classifies and analyzes the extant evidence on this issue culled from numerous empirical studies, highlighting areas where the evidence is ambiguous and further research is needed. Overall, most proxy variables used to test whether corporate hedging can lower agency costs, such as the underinvestment or the asset substitution problem, lead to fairly mixed results, though a small number of proxies, such as R&D expenditures, show effects in the predicted direction at conventional significance levels.

Similar conclusions can be drawn from tests whether corporate risk management alleviates agency conflicts between managers and shareholders. In particular, while management share programs in many cases induce firms to hedge, there is little convincing evidence that executive stock option programs lead to opposite incentives. In contrast, some support exists for the coordinated financing and investment hypothesis when examined separately from other agency costs theories. Support for positive theories based on bankruptcy and financial distress costs mainly stems from the long-term debt ratio, which may suffer from important endogeneity problems with regards to financial risk management. Other proxies, e.g. the interest coverage ratio, on the other hand, often associate with corporate hedging in the wrong direction or do not obtain significance at conventional levels.

Finally, only weak empirical support exists for the tax hypothesis, according to which corporate risk management can increase shareholder value by stabilizing taxable income, thus decreasing the average tax burden of firms in the presence of convex tax schedules. This might be attributed to the fact that the tax incentive to hedge is small compared to other positive rationales, such as the increase in debt capacity.

The comprehensive review of the existing empirical evidence thus suggests surprisingly mixed empirical support for rationales of hedging with derivatives at the firm level. At the same time, it may be that other factors not well motivated by existing risk management theory, such as earnings smoothing, speculation, or industry competition, that are difficult to examine empirically, provide a better explanation of the results (Core et al., 2002; Brown, 2001; Tufano, 1996). The results are, however, consistent with derivatives use being just one part of a broader financial strategy that considers the type and level of financial risks, the availability of risk management tools, and the operating environment of the firm. Moreover, pass-through, operational hedging, and foreign currency debt are also important dimensions of firms' hedging strategies, with derivatives possibly playing mostly a fine-tune role.

At the same time, tests of corporate hedging motives are plagued by various empirical challenges and limitations. In particular, most empirical studies face significant endogeneity and identification problems of variables describing different dimensions of corporate financial policy and strategy that are hard to address. Moreover, the impact of some variables on risk management is more complex than typically considered, and a detailed understanding of the underlying structural parameters is required in order to capture these effects properly in empirical analyses. It is also important to note that existing theories describe motives of corporate hedging in general, while empirical tests frequently focus only on one single dimen-

sion of risk management, namely on the use of financial derivatives, to proxy for hedging at the firm level. Furthermore, it is challenging to assess the extent to which firms hedge, given the complex combination of different hedging channels with different payoff profiles, time horizons, etc. as well as exposures changing over time. Finally, most empirical studies classify firms as either hedgers or non-hedgers, without allowing for the possibility that firms could move between the two groups over time. These important data and methodology issues suggest some caution when interpreting the existing empirical evidence.

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Table 1 - Overview of Proxy Variables

This table provides an overview of proxy variables used in empirical studies testing positive rationales on how corporate risk management can create shareholder value. The vertical columns on the left indicate to which broad category of positive rationales the proxy variable belongs. Note that some proxies can belong to more than one category, i.e. can be used to test more than one positive theory. Next, the proxy name and the computation formula are listed. Hypothesized sign indicates the predicted relation with corporate risk management. Source lists the empirical studies in which the proxy variable is used.

	Proxy	Proxy formula	Hyp. sign	Source
ASY INFORMATION	Analysts	Number of analysts following firm	"-"	Géczy et al. 1997
	Analysts forecast accuracy	Absolute[(Predicted - actual EPS)/price]	"-"	Lin/Smith 2007, DaDalt et al. 2002
	Analysts forecast dispersion	Standard deviation of analysts EPS forecasts	"-"	DaDalt et al. 2002
	Independence of Board	(% of) Unrelated directors on board or dummy, if CEO = COB	"+"/"-"	Mardsen/Prevost 2005, Borokhovich et al. 2004, Dionne/Triki 2004
	Institutional investors	Percentage of outstanding shares held by institutional investors	"-"	Dionne/Triki 2005, Dionne/Triki 2004, Graham/Rogers 2002, Rogers 2002, Fok et al. 1997, Géczy et al. 1997
	Multiple classes of shares	Dummy which indicates whether multiple classes of common stock exist in a firm	"+"	Bartram et al. 2007
	Blockholders	Number or percentage of outside investors holding more than 5%/10% of outstanding shares	"?"	Mardsen/Prevost 2005, Borokhovich et al. 2004, Knopf et al. 2002, Haushalter 2000, Tufano 1996
AGENCY CONFLICTS OF EQUITY	CEO cash	Sum of CEO salary and bonus (over total compensation)	"-"	Lel 2006, Knopf et al. 2002
	CEO option ownership	Number or market value of options held by CEO	"?"[c]	Dionne/Triki 2005, Knopf et al. 2002, Allayannis/Ofek 2001, Haushalter 2000
	CEO share ownership	Number or market value of shares held by CEO	"+"	Dionne/Triki 2005, Knopf et al. 2002, Allayannis/Ofek 2001, Tufano 1996
	Debt maturity	% of debt which matures in more than 1 or 2 years	"+"	Bartram et al. 2007, Géczy et al. 1997
	Option ownership	Number, dummy, or market value of shares obtainable by options (exercisable within 60 days) by managers (and directors)	"?"[a]	Bartram et al. 2007, Borokhovich et al. 2004, Dionne/Triki 2004, Haushalter 2000, Gay/Nam 1998, Géczy et al. 1997, Tufano 1996
	Sensitivity of CEO portfolio w.r.t. standard deviation of returns	Change in Black Scholes value of CEO portfolio resulting from a one percent change in the standard deviation of returns (scaled)	"-"	Lel 2006, Graham/Rogers 2002, Knopf et al. 2002, Rajgopal/Shevlin 2002, Rogers 2002
	Sensitivity of CEO portfolio w.r.t. stock price	Change in Black Scholes value of CEO portfolio resulting from a one percent change in the stock price	"+"	Lel 2006, Graham/Rogers 2002, Knopf et al. 2002
	Share ownership	Market value of shares owned by managers (and directors)	"+"	Lel 2006, Dionne/Triki 2004, Haushalter 2000, Gay/Nam 1998, Fok et al. 1997, Géczy et al. 1997, Tufano 1996
	% Share ownership	Shares owned by managers (and directors)/total outstanding shares	"+"	Mardsen/Prevost 2005, Haushalter 2000, Berkman/Bradbury 1996
	Officer's tenure	Number of years officers hold in their current job	"-"	Tufano 1996
AGENCY CONFLICTS OF DEBT	Acquisition activities	Acquisition activities' value (scaled)	"+"	Dionne/Triki 2004, Dionne/Garand 2003, Haushalter 2000, Tufano 1996
	Asset growth ratio	Current year change in net tangible assets + depreciation/ net income + depreciation	"+"	Berkman/Bradbury 1996
	Book-to-market (or inverse); sometimes called Tobin's Q	Book value of common equity/market value of common equity	"-"	Bartram et al. 2007, Lel 2006, Mardsen/Prevost 2005, Borokhovich et al. 2004, Graham/Rogers 2002, Knopf et al. 2002, Rajgopal/Shevlin 2002, Rogers 2002, Allayannis et al. 2001, Allayannis/Ofek 2001, Guay 1999, Gay/Nam 1998, Fok et al. 1997, Géczy et al. 1997, Mian 1996, Nance et al. 1993
	Earnings-price ratio (or inverse)	Earnings/share price	"-"	Bartram et al. 2007, Gay/Nam 1998, Berkman/Bradbury 1996, Dolde 1995, Francis/Stephan 1990
	Exploration activities	Exploration expenditures (scaled)	"+"	Dionne/Triki 2005, Dionne/Triki 2004, Dionne/Garand 2003, Rajgopal/Shevlin 2002, Haushalter 2000, Tufano 1996
	Market-adjusted cumulative returns	Cumulative firm return (over market return)	"+"	Gay/Nam 1998
	Market-to-book/leverage interaction	Market-to-book * leverage	"+"	Bartram et al. 2007, Graham/Rogers 2002, Allayannis et al. 2001
	Property, plant, & equipment	Capital expenditures (scaled)	"+"	Bartram et al. 2007, Lin/Smith 2007, Dionne/Triki 2004, Rogers 2002, Allayannis et al. 2001, Haushalter 2000, Géczy et al. 1997
	Regulated industry	Dummy which indicates whether a firm is in a regulated industry	"-"	Rogers 2002, Mian 1996
	Research and development	R&D (scaled)	"+"	Bartram et al. 2007, Lin/Smith 2007, Graham/Rogers 2002, Knopf et al. 2002, Rogers 2002, Allayannis/Ofek 2001, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Dolde 1995, Nance et al. 1993

(continued)

Table 1 - Overview of Proxy Variables (continued)

	Proxy	Proxy formula	Hyp. sign	Source
COSTS OF BANKRUPTCY AND FINANCIAL DISTRESS	Advertising expenses	Advertising expsenses (scaled)	"+"	Dolde 1995
	Altman Z score	Bankruptcy index	"-"	Francis/Stephan 1990
	Bond rating	Dummies for AAA+ to D-rated companies	"-"	Haushalter 2000, Dolde 1995
	Cash flow availibility	Cash flow (scaled)	"-"	Haushalter 2000, Howton/Perfect 1998
	Convertible debt	Book value of convertible debt (scaled)	"?"	Bartram et al. 2007, Lel 2006, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Nance et al. 1993
	Credit risk spread	Spread between bond yield and 10-year Treasury notes	"+"	Dolde 1995
	Current ratio	[Current Assets(-Total) / Current Liabilities(-Total)]	"-"	Bartram et al. 2007, Mardsen/Prevost 2005, Allayannis et al. 2001
	Dividend yield/dividend pay-out ratio	Cash dividend/closing share price; cash dividend/total earnings; or dividend dummy	"?"	Bartram et al. 2007, Lel 2006, Mardsen/Prevost 2005, Dionne/Garand 2003, Knopf et al. 2002, Rajgopal/Shevlin 2002, Allayannis/Ofek 2001, Haushalter 2000, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Mian 1996, Nance et al. 1993, Francis/Stephan 1990
	Interest coverage ratio	EBIT/interest	"-"	Bartram et al. 2007, Knopf et al. 2002, Allayannis et al. 2001, Guay 1999, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Nance et al. 1993, Francis/Stephan 1990
	Leverage to cash comparison	Dummy which indicates that a firm has an above sample median leverage ratio and a below medain current ratio	"+"	Haushalter 2000
	Long-term debt ratio	[Book value of long-term debt (+ book value of short-term debt)] /total assets (or alternative)	"+"	Bartram et al. 2007, Lin/Smith 2007, Lel 2006, Dionne/Triki 2005, Mardsen/Prevost 2005, Borokhovich et al 2004, Dionne/Triki 2004, Dionne/Garand 2003, Graham/Rogers 2002, Knopf et al. 2002, Rajgopal/Shevlin 2002, Rogers 2002, Allayannis et al. 2001, Allayannis/Ofek 2001, Haushalter 2000, Guay 1999, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Mian 1996, Tufano 1996, Dolde 1995, Nance et al. 1993, Francis/Stephan 1990, Block/Gallagher 1986
	Operating leverage or: cash costs	Production costs per unit of output	"+"	Dionne/Triki 2004, Dionne/Garand 2003, Haushalter 2000, Tufano 1996
	Preferred stock	Book value of preferred stock (scaled)	"?"	Bartram et al. 2007, Dionne/Garand 2003, Knopf et al. 2002, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Nance et al. 1993
	Profitability (1)	EBIT/sales (gross margin)	"-"	Bartram et al. 2007, Dionne/Triki 2004, Allayannis et al. 2001
	Profitability (2)	Sales	"-"	Dionne/Triki 2004, Allayannis et al. 2001, Fok et al. 1997, Dolde 1995, Francis et al. 1993, Houston/Mueller 1988
	Profitability (3)	Return on assets (ROA)	"-"	Bartram et al. 2007, Rogers 2002, Allayannis/Ofek 2001, Guay 1999
	Reserves	Proven and probable reserves	"-"	Dionne/Garand 2003, Tufano 1996
	SG&A expenses	SG&A expenses (scaled)	"+"	Dionne/Triki 2004, Dolde 1995
	Short-term liquidity (quick ratio)	Cash+short-term investments/current liabilities	"-"	Bartram et al. 2007, Lin/Smith 2007, Borokhovich et al. 2004, Dionne/Triki 2004, Dionne/Garand 2003, Rajgopal/Shevlin 2002, Allayannis et al. 2001, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Mian 1996, Tufano 1996, Nance et al. 1993
	Size	Market value of common stock + book value of debt and preferred stock; alternatively total assets	"-"	Bartram et al. 2007, Lin/Smith 2007, Lel 2006, Mardsen/Prevost 2005, Borokhovich et al. 2004, Dionne/Triki 2004, Dionne/Garand 2003, Graham/Rogers 2002, Knopf et al. 2002, Rajgopal/Shevlin 2002, Rogers 2002, Allayannis/Ofek 2001, Haushalter 2000, Guay 1999, Gay/Nam 1998, Howton/Perfect 1998, Fok et al. 1997, Géczy et al. 1997, Berkman/Bradbury 1996, Mian 1996, Tufano 1996, Nance et al. 1993, Francis/Stephan 1990, Houston/Mueller 1988, Block/Gallagher 1986
	Tangible assets	Tangible assets (scaled)	"-"	Bartram et al. 2007, Howton/Perfect 1998
	Tax-loss carry-forwards (1)	Dummy which indicates the availibility of TLCFs	"+"	Mardsen/Prevost 2005, Allayannis/Ofek 2001, Howton/Perfect 1998, Mian 1996, Berkman/Bradbury 1996
	Tax-loss carry-forwards (2)	Absolute available TLCFs (scaled)	"+"	Lin/Smith 2007, Graham/Rogers 2002, Knopf et al. 2002, Rogers 2002, Gay/Nam 1998, Fok et al. 1997, Géczy et al. 1997, Tufano 1996, Dolde 1995, Nance et al. 1993
TAXES	Marginal (or: average) tax rates	Current year's marginal tax rate (or: average tax rate per year)	"-"	Bartram et al. 2007, Dionne/Triki 2004, Haushalter 2000, Francis/Stephan 1990
	Progressive corporate tax structure	Dummy which indicates whether any part of a 95% confidence interval around reported earnings lies inside the convex tax region	"+"	Howton/Perfect 1998, Mian 1996, Nance et al. 1993
	Tax credits (1)	Dummy which indicates the availibility of TCs	"+"	Bartram et al. 2007, Mian 1996
	Tax credits (2)	Absolute available TCs (scaled) or deferred income (scaled)	"+"	Bartram et al. 2007, Dionne/Garand 2003, Fok et al. 1997, Nance et al. 1993
	Tax savings	Expected tax liability for full volatility case - expected tax liability with volatility reduced by 5%/sales	"+"	Dionne/Triki 2005, Dionne/Triki 2004, Dionne/Garand 2003, Graham/Rogers 2002

Table 2 - Empirical Evidence on Asymmetric Information Hypothesis

This table provides an overview of the evidence on rationales how corporate risk management can increase firm value in the presence of asymmetric information. For each proxy, the predicted sign is indicated (whenever determinable). A 'yes' in the table indicates that the evidence is in the predicted direction, 'no' indicates the opposite and a 'question mark' an unclear direction. Numbers below 'yes', 'no' and 'question mark' are p-values. Note that these p-values cannot be always taken literally, as most studies test many different specifications. Thus, 0.1 implies some weak evidence, 0.05 some strong and weak evidence, and 0.01 strong evidence. Significance at conventional levels (p-value < 10%) in the correct direction is indicated as boldface in the table. Panel A presents univariate results, whereas Panel B presents multivariate results.

Proxies	Analysts	Analysts accuracy	Analysts dispersion	Blockholders	Independ. Board	Institutional investors	Multiple share classes
Hypothesized sign	"-"	"-"	"-"	"?"	"+"	"-"	"+"
PANEL A: Univariate Results							
Bartram et al. 2007							**yes**
							0.01
Lin/Smith 2007		yes					
		no					
Dionne/Triki 2005						no	
						no	
Mardsen/Prevost 2005[1]				pos./neg.	no/no		
				no/no	no/no		
Dionne/Triki 2004					no	**yes**	
					0.01	**0.01**	
DaDalt et al. 2002		yes[FX]/yes[IR]	yes[FX]/yes[IR]				
		0.01/no	**0.01/0.1**				
Haushalter 2000				"?"			
				0.01			
Fok et al. 1997						no	
						0.01	
Gézcy et al. 1997	no					no	
	0.01					0.01	
Tufano 1996				**neg.**			
				0.1			
PANEL B: Multivariate Results							
Bartram et al. 2007							**yes**
							0.01
Lin/Smith 2007		no					
		no					
Dionne/Triki 2005						**yes**	
						0.01	
Mardsen/Prevost 2005[1]				neg.	no/no		
				no	no/no		
Borokhovich et al. 2004				neg.	**yes**		
				no	**0.05**		
Dionne/Triki 2004					yes	**yes**	
					no	**0.01**	
DaDalt et al. 2002		**yes**	**yes**				
		0.01	**0.01**				
Graham/Rogers 2002						no	
						0.1	
Knopf et al. 2002				neg.			
				no			
Rogers 2002						no	
						0.05	
Haushalter 2000				**neg.**			
				0.05			
Fok et al. 1997						no	
						0.01	
Gézcy et al. 1997	no						
	0.01						
Tufano 1996				**neg.**			
				0.05			

[1] The numbers on the left of each entry are for the year 1994 and the numbers on the right for the year 1997.
[IR] Evidence relates only to interest rates derivatives; [FX] Evidence relates only to foreign exchange rate derivatives.

Table 3 - Empirical Evidence on Shareholder-Debtholder Conflicts Hypothesis

This table provides an overview of the evidence on rationales how corporate risk management can increase firm value in the presence of agency conflicts between shareholders and bondholders. For each proxy, the predicted sign is indicated (whenever determinable). A 'yes' in the table indicates that the evidence is in the predicted direction, 'no' indicates the opposite and a 'question mark' an unclear direction. Numbers below 'yes', 'no' and 'question mark' are p-values. Note that these p-values cannot be always taken literally, as most studies test many different specifications. Thus, 0.1 implies some weak evidence, 0.05 some strong and weak evidence, and 0.01 strong evidence. Significance at conventional levels (p-value < 10%) in the correct direction is indicated as boldface in the table. Panel A presents univariate results, whereas Panel B presents multivariate results.

PANEL A: Univariate Results

Proxies	Acq. act.	Asset growth	Book-to-market	Earnings-to-price ratio	Exploration activities	Market-adj. cum. returns	M-to-B * leverage	Property, plant & equipment	Reg. Ind.	R&D
Hypothesized sign	"+"	"+"	"-"	"-"	"+"	"+"	"+"	"+"	"-"	"+"
Bartram et al. 2007			no				**yes**	no		no
			0.05				**0.01**	0.01		0.01
Lin/Smith 2007								yes		no
								no		no
Lel 2006[1]			no							
			0.01							
Dionne/Triki 2005					yes					
					no					
Mardsen/Prevost 2005[2]			no/no							
			no/no							
Dionne/Triki 2004	yes				yes					
	no				no					
Allayannis et al. 2001			yes					no		
			no					no		
Haushalter 2000								yes		
								no		
Guay 1999			**yes**							
			0.1							
Gay/Nam 1998			no	yes		**yes**				**yes**
			no	no		**0.05**				**0.05**
Fok et al. 1997			no							**yes**
			no							**0.01**
Gézcy et al. 1997			**yes**					no		**yes**
			0.01					0.05		**0.01**
Berkman/Bradbury 1996		no		no						
		no		0.05						
Mian 1996			no						**yes**	
			0.01[IR]						**0.05**[FX]	
Tufano 1996	no				no					
	no				no					
Dolde 1995			**yes**							**yes**
			0.05							**0.05**
Nance et al. 1993			no							**yes**
			no							**0.05**
Francis/Stephan 1990				no						
				no						

(continued)

Table 3 - Empirical Evidence on Shareholder-Debtholder Conflicts Hypothesis (continued)

PANEL B: Multivariate Results

Proxies	Acq. act.	Asset growth	Book-to-market	Earnings-to-price ratio	Exploration activities	Market-adj. cum. returns	M-to-B * leverage	Property, plant & equipment	Regulated industry	R&D
Hypothesized sign	"+"	"+"	"-"	"-"	"+"	"+"	"+"	"+"	"-"	"+"
Bartram et al. 2007			no				yes			
			0.01				0.05			
Lin/Smith 2007										yes
										0.01
Lel 2006[1]			yes/no				yes/no			
			0.05/no				0.1/0.1			
Dionne/Triki 2005					no					
					no					
Mardsen/Prevost 2005[2]			no/no							
			0.05/no							
Borokhovich et al. 2004			yes							
			0.1							
Dionne/Triki 2004	no				no					
	0.1				no					
Dionne/Garand 2003	no							no		
	no							no		
DaDalt et al. 2002										
Graham/Rogers 2002			no				yes			no
			0.01				0.05			0.05
Knopf et al. 2002			yes							yes
			0.05							0.01
Rajgopal/Shevlin 2002			yes	yes						
			0.1	0.1						
Rogers 2002			no					yes	yes	yes
			no					no	0.01	0.01
Allayannis et al. 2001			yes				yes	no		
			no				no	no		
Allayannis/Ofek 2001			no							yes
			no							0.05
Haushalter 2000	yes				no			yes		
	no				0.05			no		
Guay 1999			yes							
			0.05							
Gay/Nam 1998			yes	yes		yes				yes
			0.01	0.01		0.05				0.05
Howton/Perfect 1998										yes
										0.01
Fok et al. 1997			no							yes
			no							0.01
Gézcy et al. 1997			yes				yes			yes
			no				0.1			0.01
Berkman/Bradbury 1996		no		yes						
		no		0.1[fair]						
Mian 1996			no						yes	
			0.01[IR]						0.05	
Tufano 1996	no				no					
	no				0.1					
Dolde 1995										yes
										0.05
Nance et al. 1993			yes							yes
			no							0.1
Francis/Stephan 1990				yes						
				no						

[1] The numbers on the left of each entry apply to firms with strong and the numbers on the right to firms with weak corporate governance structures (Lel, 2006).
[2] The numbers on the left of each entry are for the year 1994 and the numbers on the right for the year 1997.
[IR] Evidence relates only to interest rates derivatives; [FX] Evidence relates only to foreign exchange rate derivatives.
[Fair] Evidence relates only to the tests in which derivatives use is measured as fair values; [Not] (notional) Evidence relates only to the tests in which derivatives use is measured by notional values.

Table 4 - Empirical Evidence on Manager-Shareholder Conflicts Hypothesis

This table provides an overview of the evidence on rationales how corporate risk management can increase firm value in the presence of agency conflicts between managers and shareholders. For each proxy, the predicted sign is indicated (whenever determinable). A 'yes' in the table indicates that the evidence is in the predicted direction, 'no' indicates the opposite and a 'question mark' an unclear direction. Numbers below 'yes', 'no' and 'question mark' are p-values. Note that these p-values cannot be always taken literally, as most studies test many different specifications. Thus, 0.1 implies some weak evidence, 0.05 some strong and weak evidence, and 0.01 strong evidence. Significance at conventional levels (p-value < 10%) in the correct direction is indicated as boldface in the table. Panel A presents univariate results, whereas Panel B presents multivariate results.

Proxies	Blockholders	CEO option ownership	CEO share ownership	Option ownership	Sensitivity CEO price	Sensitivity CEO sigma	Share ownership	% Share ownership	Tenure executives
Hypothesized sign	"?"	"?"	"+"	"?"	"+"	"-"	"+"	"+"	"-"
PANEL A: Univariate Results									
Bartram et al. 2007				**pos.** **0.05**					
Lel 2006[1]							no 0.05		
Dionne/Triki 2005		**pos.** **0.01**	**yes** **0.05**						
Mardsen/Prevost 2005[2]	pos./neg. no/no							no/yes no/no	
Dionne/Triki 2004				**pos.** **0.01**			**yes** **0.01**		
Haushalter 2000	"?" 0.01	**pos.** **0.05**		neg. 0.05			**yes** **no**	no 0.05	
Gay/Nam 1998				**pos.** **no**			no 0.05		
Fok et al. 1997							no 0.01		
Gézcy et al. 1997				**pos.** **0.01**			**yes** **0.1**		
Berkman/Bradbury 1996								no no	
Tufano 1996	**neg.** **0.1**			**pos.** **0.1**			**yes** **0.1**		
PANEL B: Multivariate Results									
Bartram et al. 2007				**pos.** **0.05**					
Lel 2006[1]					**no/yes** **no/0.05**	**no/yes** **no/0.01**	**yes/yes** **no/0.01**		
Dionne/Triki 2005		**neg.** **0.01**	**yes** **0.01**						
Mardsen/Prevost 2005[2]	neg. no							no no	
Borokhovich et al. 2004	neg. no			neg. no					
Dionne/Triki 2004				**neg.** **0.05**			**yes** **0.01**		
Graham/Rogers 2002					**yes** **0.1**	no no			
Knopf et al. 2002	neg. no	**pos.** **0.01**	no no	**pos.** **0.01**	**yes** **0.05**	yes no			
Rajgopal/Shevlin 2002							**yes** **0.01**		
Rogers 2002							**yes** **0.01**		
Allayannis/Ofek 2001		"?" no	"?" no						
Haushalter 2000	**neg.** **0.05**	**pos.** **0.05**		neg. 0.05			no 0.05	no 0.05	
Gay/Nam 1998				**pos.** **0.1**			no no		
Fok et al. 1997							no 0.05		
Gézcy et al. 1997				pos. no			yes no		
Berkman/Bradbury 1996								**yes** **0.1**[fair]	
Tufano 1996	**neg.** **0.05**		yes no	**neg.** **0.05**			**yes** **0.05**		**yes** **0.1**

[1] The numbers on the left of each entry apply to firms with strong and the numbers on the right to firms with weak corporate governance structures (Lel, 2006).
[2] The numbers on the left of each entry are for the year 1994 and the numbers on the right for the year 1997.
[Fair] Evidence relates only to the tests in which derivatives use is measured as fair values; [Not] (notional) Evidence relates only to the tests in which derivatives use is measured by notional values.

Table 5 - Empirical Evidence of Financial Distress Hypothesis

This table provides an overview of the evidence on rationales how corporate risk management can increase firm value in the presence of financial distress costs. For each proxy, the predicted sign is indicated (whenever determinable). A 'yes' in the table indicates that the evidence is in the predicted direction, 'no' indicates the opposite and a 'question mark' an unclear direction. Numbers below 'yes', 'no' and 'question mark' are p-values. Note that these p-values cannot be always taken literally, as most studies test many different specifications. Thus, 0.1 implies some weak evidence, 0.05 some strong and weak evidence, and 0.01 strong evidence. Significance at conventional levels (p-value < 10%) in the correct direction is indicated as boldface in the table. Panel A presents univariate results, whereas Panel B presents multivariate results.

PANEL A: Univariate Results

Proxies	Advert. Exp.	Cash costs	Conv. debt	Credit rating	Div. yield	Int. cov. ratio	Gross margin	Debt ratio	Pref. stock	Re-serves	ROA	Sales	SG&A costs	Short-term liquidity	Size	Tangible assets	Z score
Hypothesized sign	"+"	"+"	"?"	"-"	"?"	"-"	"-"	"+"	"?"	"-"	"-"	"-"	"+"	"-"	"-"	"-"	"-"
Bartram et al. 2007			**pos.**		**pos.**	no	no	**yes**	**pos.**		no			**yes**	no		**yes**
			0.01		**0.01**	0.01	0.01	**0.01**	**0.01**		0.01			**0.01**	0.01		**0.01**
Lin/Smith 2007								**yes**						**yes**	no		
								0.01						**0.01**	0.01		
Lel 2006[1]								**yes**							no		
								0.01							0.01		
Dionne/Triki 2005								**yes**									
								0.05									
Mardsen/Prevost 2005[2]					neg./pos.			yes/yes						yes/yes	no/no		
					no/0.05			0.01/no						no/0.1	0.01/0.01		
Dionne/Triki 2004		**yes**						**yes**				no		**yes**	no		
		0.01						**0.01**				0.01		**0.01**	0.01		
Allayannis et al. 2001						no	no	no				no		yes			
						no	0.1	no				no		no			
Haushalter 2000		no		**yes**	neg.			**yes**							**yes**		
		0.01		**0.01**	**0.01**			**0.01**							**0.01**		
Guay 1999						no		**yes**			no				no		
						no		**0.05**			0.05				0.01		
Gay/Nam 1998			pos.			no		**yes**	**pos.**						yes		
			no			no		**0.01**	**0.1**						no		
Fok et al. 1997			**neg.**		pos.		**yes**	yes	**pos.**			no		**yes**	no		
			0.1		no		**0.1**	no	**0.1**			0.01		**0.01**	0.01		
Gézcy et al. 1997			neg.		neg.		yes	no	neg.					**yes**	no		
			no		no		no	0.1	no					**0.1**	0.01		
Berkman/Bradbury 1996			**pos.**		**pos.**		yes	**yes**	**pos.**					**yes**	no		
			0.05		**0.01**		no	**0.01**	**0.05**					**0.01**	0.01		
Mian 1996					**pos.**			**yes**						**yes**	no		
					0.1			**0.1**						**0.1**	0.01		
Tufano 1996		yes						yes		no				**yes**	no		
		no						no		no				**0.05**	no		
Dolde 1995	**yes**			no				no				no	**yes**				
	0.1			no				no				0.01	**0.05**				
Nance et al. 1993			neg.		**pos.**	yes		no	neg.					**yes**	no		
			no		**0.01**	no		no	no					**0.1**	0.01		
Francis/Stephan 1990					**pos.**	yes		**yes**				no			no		yes
					0.01	no		**0.05**				0.01			0.01		no
Houston/Mueller 1988												no			no		
												no			no		
Block/Gallagher 1986								yes							no		
								no							0.01		

(Continued)

Table 5 - Empirical Evidence of Financial Distress Hypothesis (continued)

PANEL B: Multivariate Results

Proxies	Advert. Exp.	Cash costs	Conv. debt	Credit rating	Div. yield	Int. cov. ratio	Gross margin	Debt ratio	Pref. stock	Re-serves	ROA	Sales	SG&A costs	Short-term liquidity	Size	Tangible assets	Z score
Hypothesized sign	"+"	"+"	"?"	"-"	"?"	"-"	"-"	"+"	"?"	"-"	"-"	"-"	"+"	"-"	"-"	"-"	"-"
Bartram et al. 2007					**pos.**	no	**yes**	**yes**						**yes**	no		
					0.01	no	0.1	0.01						0.01	0.01		
Lin/Smith 2007								**yes**						**yes**	no		
								0.01						0.01	0.01		
Lel 2006[1]		**neg./neg.**			pos./neg.			**yes/yes**							no/no		
		0.01/no			no/no			0.01/no							0.01/0.01		
Dionne/Triki 2005								**yes**									
								0.01									
Mardsen/Prevost 2005[2]					neg.			**yes**						**yes**	no		
					no			0.05						0.1	0.01		
Borokhovich et al. 2004								**yes**						yes	no		
								0.01						no	0.01		
Dionne/Triki 2004	**yes**							**yes**				no		no			
	0.05							0.05				no		0.01			
Dionne/Garand 2003	**yes**				**neg.**			**yes**	neg.	no				**yes**			
	0.01				0.01			0.01	0.01	0.01				0.1			
Graham/Rogers 2002								**yes**							no		
								0.01							0.01		
Knopf et al. 2002					pos.	yes		**yes**	neg.						yes		
					no	no		0.01	no						no		
Rajgapol/Shevlin 2002					pos.			no						**yes**	no		
					no			no						0.01	0.05		
Rogers 2002								**yes**				yes			no		
								0.1				0.01			0.01		
Allayannis et al. 2001							no	no				yes		**yes**			
							0.01	no				0.1		0.05			
Allayannis/Ofek 2001					neg.			no			no				yes		
					no			0.05			no				no		
Haushalter 2000	**yes**		yes		**neg.**		**yes**	**yes**							yes		
	0.05		0.1		0.01		0.01	0.01							no		
Guay 1999					**yes**			**yes**			yes				no		
					0.05			0.05			no				0.05		
Gay/Nam 1998			neg.			yes		**yes**	neg.						yes		
			no			no		0.01	no						no		
Howton/Perfect 1998			zero			no		**yes**	zero					**yes**	no	**yes**	
			no			no		0.05[IR]	no					0.05	no	0.1[IR]	
Fok et al. 1997			**neg.**		pos.	**yes**		**yes**	pos.			no		**yes**	no		
			0.05		no	0.01		0.1	no			0.01		0.1	0.01		
Gézcy et al. 1997								no						**yes**	no		
								no						0.05	0.01		
Berkman/Bradbury 1996			pos./neg.		**pos.**	yes		**yes**	pos./neg.					**yes**	no		
			no		0.1	0.01		0.01	no					0.05[fair]	0.01		
Mian 1996															no		
															0.01		
Tufano 1996		yes						yes		**yes**				**yes**	no		
		no						no		0.1				0.1	no		
Dolde 1995								**yes**				no	**yes**				
								0.05				no	0.1				
Nance et al. 1993			pos.		**pos.**	yes		no	neg.						yes	no	
			no		0.01	no		no	no						no	0.1	
Francis/Stephan 1990					pos./neg.			yes				no					yes
					no			no				0.01					no

[1] The numbers on the left of each entry apply to firms with strong and the numbers on the right to firms with weak corporate governance structures (Lel, 2006).
[2] The numbers on the left of each entry are for the year 1994 and the numbers on the right for the year 1997.
[IR] Evidence relates only to interest rates derivatives; [FX] Evidence relates only to foreign exchange rate derivatives.
[Fair] Evidence relates only to the tests in which derivatives use is measured as fair values; [Not] (notional) Evidence relates only to the tests in which derivatives use is measured by notional values.

Table 6 - Empirical Evidence of Taxes Hypothesis

Table 6 - Empirical Evidence of Taxes Hypothesis

This table provides an overview of the evidence on rationales how corporate risk management can increase firm value in the presence of convex tax schedules. For each proxy, the predicted sign is indicated (whenever determinable). A 'yes' in the table indicates that the evidence is in the predicted direction, 'no' indicates the opposite and a 'question mark' an unclear direction. Numbers below 'yes', 'no' and 'question mark' are p-values. Note that these p-values cannot be always taken literally, as most studies test many different specifications. Thus, 0.1 implies some weak evidence, 0.05 some strong and weak evidence, and 0.01 strong evidence. Significance at conventional levels (p-value < 10%) in the correct direction is indicated as boldface in the table. Panel A presents univariate results, whereas Panel B presents multivariate results.

PANEL A: Univariate Results

Proxies	Prog. corp. tax structure	Marginal (or average) tax rates	Tax credits	Tax credits dummy	Tax-loss carry-forwards	Tax-loss carry-forwards dummy	Tax savings
Hypothesized sign	"+"	"-"	"+"	"+"	"+"	"+"	"+"
Bartram et al. 2007			**yes** **0.01**				
Lin/Smith 2007					no 0.01		
Dionne/Triki 2005							yes no
Mardsen/Prevost 2005[1]						**yes/no** **0.05/no**	
Dionne/Triki 2004							no no
Haushalter 2000		no 0.01					
Gay/Nam 1998					**yes** **0.05**		
Fok et al. 1997			**yes** **0.05**		yes no		
Gézcy et al. 1997					no no		
Berkman/Bradbury 1996						**yes** **0.05**	
Mian 1996	no 0.01			**yes** **0.01**		no 0.01	
Tufano 1996					yes no		
Dolde 1995					**yes** **0.01**		
Nance et al. 1993	**yes** **0.1**		**yes** **0.01**		no no		
Francis/Stephan 1990		no no					

(Continued)

Table 6 - Empirical Evidence of Taxes Hypothesis (continued)

PANEL B: Multivariate Results

Proxies	Prog. corp. tax structure	Marginal (or: average) tax rates	Tax credits	Tax credits dummy	Tax-loss carry-forwards	Tax-loss carry-forwards dummy	Tax savings
Hypothesized sign	"+"	"-"	"+"	"+"	"+"	"+"	"+"
Bartram et al. 2007			**yes** **0.01**				
Lin/Smith 2007					no 0.01		
Dionne/Triki 2005							**yes** **0.01**
Mardsen/Prevost 2005[1]						yes no	
Dionne/Triki 2004							no no
Dionne/Garand 2003			**yes** **0.05**				**yes** **0.01**
Graham/Rogers 2002					no 0.05		no no
Knopf et al. 2002					no no		
Rogers 2002					no 0.1		
Allayannis/Ofek 2001						yes no	
Haushalter 2000	**yes** **0.01**	no 0.05					
Gay/Nam 1998					no no		
Howton/Perfect 1998	**yes** **0.01**					no no	
Fok et al. 1997			yes no		no no		
Gézcy et al. 1997					yes no		
Berkman/Bradbury 1996						**yes** **0.05**	
Mian 1996	yes no			**yes** **0.01**[FX]		yes no	
Tufano 1996					yes no		
Dolde 1995					**yes** **0.1**		
Nance et al. 1993	yes no		**yes** **0.05**		yes no		
Francis/Stephan 1990		no no					

[1] The numbers on the left of each entry are for the year 1994 and the numbers on the right for the year 1997.
[IR] Evidence relates only to interest rates derivatives; [FX] Evidence relates only to foreign exchange rate derivatives.